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| 10/542,076 | 07/13/2005 | Kai Eck | PHDE030024US | 8935 |

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| EXAMINER | |
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| ZEILBERGER, DANIEL | |
| ART UNIT | PAPER NUMBER |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/542,076 | ECK, KAI | |
| | Examiner | Art Unit | |
| | Daniel Zeilberger | 4115 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *13 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 6, 7, and 8 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for determining the position of an object in an image by correlating the marking elements with a filter, does not reasonably provide enablement for every possible way of determining the position of an object in an image. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. See MPEP 2164.08(a).

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. *Claims 1, 6, 7, 9, 10, 11, and 13* are rejected under 35 U.S.C. 102(b) as being anticipated by Schuetz (US Patent 6,206,566).

5. Regarding **claim 1**, Schuetz discloses an x-ray apparatus for producing a 3D image from a set of 2D projections. In addition, Schuetz discloses a method of determining the position of an object in an image, wherein:

6. that the intrinsic imaging parameters, which specify the distance of the X-ray source 9 from the X-ray detector 10, the orientation of the X-ray source 9 relative to the X-ray detector 10, and a possible displacement of the X-ray detector 10 perpendicular to the axis of the center beam ZS of the X-ray beam emanating from the X-ray source 9, are detected using a marker plate 19, wherein the marking plate 19 is constructed of an X-ray permeable material such as plexiglass, and is provided with four X-ray positive spherical marks 20, as disclosed in column 6 lines 44-63, which reads on claimed "a method of determining the position of an object in an image wherein a pattern of marking elements is attached to the object".

7. In addition, Schuetz discloses that should the imaged marks 20' prove disturbing in the 2D projections, the imaged marks 20' can subsequently be calculated out of the 2D projections in an image processing step, as disclosed in column 6 lines 63-67 and column 7 lines 1-2, which reads on claimed "marking elements which are not visibly evident individually in the image".

8. Regarding **claim 6**, Schuetz discloses that the intrinsic imaging parameters, which specify the distance of the X-ray source 9 from the X-ray detector 10, the orientation of the X-ray source 9 relative to the X-ray detector 10, and a possible displacement of the X-ray detector 10 perpendicular to the axis of the center beam ZS of the X-ray beam emanating from the X-ray source 9, are detected using a marker

plate 19, as disclosed in column 6 lines 44-63, which reads on claimed "marking means for attaching to an object in order to determine its position in an image".

9. In addition, Schuetz discloses that the marker plate 19 is constructed of an X-ray permeable material such as plexiglass, and is provided with four X-ray positive spherical marks 20, which are arranged in the marker plate 19 such that they are situated in different image corners, as disclosed in column 6 lines 53-60, which reads on claimed "the marking elements comprise marking elements arranged in a pattern".

10. In addition, Schuetz discloses that should the imaged marks 20' prove disturbing in the 2D projections, the imaged marks 20' can subsequently be calculated out of the 2D projections in an image processing step, as disclosed in column 6 lines 63-67 and column 7 lines 1-2, which reads on claimed marking elements "which are not visibly evident individually in the image".

11. Regarding **claim 7**, Schuetz discloses everything as applied above in regards to claim 6. In addition, Schuetz discloses that the marker plate 19 is constructed of an X-ray permeable material such as plexiglass as disclosed in column 6 lines 53-60, which reads on claimed "wherein the marking elements are applied to a transparent carrier".

12. Regarding **claim 9**, Schuetz discloses an X-ray system, comprising:

13. an X-ray source 9, wherein a center beam ZS of the X-ray beam emanates from the X-ray source 9, as disclosed in column 6 lines 44-51, which reads on claimed "an X-ray source generating a ray path";

14. an X-ray detector 10, which is in the path of the center beam ZS of the X-ray beam, as disclosed in column 6 lines 44-51 and exhibited in figure 1, which reads in claimed "an X-ray detector which is disposed in the ray path of the X-ray source";

15. the intrinsic imaging parameters, which specify the distance of the X-ray source 9 from the X-ray detector 10, the orientation of the X-ray source 9 relative to the X-ray detector 10, and a possible displacement of the X-ray detector 10 perpendicular to the axis of the center beam ZS of the X-ray beam emanating from the X-ray source 9, are detected using a marker plate 19, as disclosed in column 6 lines 44-63, which reads on claimed "marking means for attaching to an object in order to determine its position in an image". "at least one marking means for attachment to an object in order to determine the position of the object in an X-ray image";

16. the marker plate 19 is constructed of an X-ray permeable material such as plexiglass, and is provided with four X-ray positive spherical marks 20, which are arranged in the marker plate 19 such that they are situated in different image corners, as disclosed in column 6 lines 53-60, which reads on claimed "the marking elements comprise marking elements";

17. should the imaged marks 20' prove disturbing in the 2D projections, the imaged marks 20' can subsequently be calculated out of the 2D projections in an image processing step, as disclosed in column 6 lines 63-67 and column 7 lines 1-2, which reads on claimed marking elements "which are not visibly evident individually in the X-ray image";

18. the evaluation of the 2D projections is made by the computer 14, which determines the intrinsic imaging parameters using the known geometric positions of the marks 20 in the second coordinate system K2 and the distance relations of the imaging marks 20' in the 2D projections, as disclosed in column 7 lines 12-20, which reads on claimed "a data processing unit for calculation of the position of the marking means in an image generated with the X-ray system".

19. Regarding **claim 10**, Shuetz discloses everything as applied above in regards to claim 9. In addition, Schuetz discloses that the intrinsic imaging parameters, which specify the distance of the X-ray source 9 from the X-ray detector 10, the orientation of the X-ray source 9 relative to the X-ray detector 10, and a possible displacement of the X-ray detector 10 perpendicular to the axis of the center beam ZS of the X-ray beam emanating from the X-ray source 9, are detected using a marker plate 19, wherein the marking plate 19 is constructed of an X-ray permeable material such as plexiglass, and is provided with four X-ray positive spherical marks 20, as disclosed in column 6 lines 44-63, and that should the imaged marks 20' prove disturbing in the 2D projections, the imaged marks 20' can subsequently be calculated out of the 2D projections in an image processing step, as disclosed in column 6 lines 63-67 and column 7 lines 1-2, which reads on claimed "wherein it is set up to implement a method as claimed in claim 1".

20. Regarding **claim 11**, Schuetz discloses everything as applied above in regards to claim 9. In addition, Schuetz discloses that the marker plate 19 is constructed of an X-ray permeable material such as plexiglass, and is provided with four X-ray positive spherical marks 20, which are arranged in the marker plate 19 such that they are

situated in different image corners, as disclosed in column 6 lines 53-60, which reads on claimed "said marking elements are arranged in a pattern".

21. Regarding **claim 13**, Schuetz discloses everything as applied above in regards to claim 9. In addition, Schuetz discloses that the marker plate 19 is constructed of an X-ray permeable material such as plexiglass, as disclosed in column 6 lines 53-60, which reads on claimed "said marking elements are applied to a transparent carrier".

***Claim Rejections - 35 USC § 103***

22. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

23. *Claims 2 and 3* are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuetz in view of Seeley et al. (US Patent 6,484,049), hereinafter referenced as Seeley.

24. Regarding **claim 2**, Schuetz discloses everything as applied above in regards to claim 1. In addition, Schuetz discloses that the evaluation of the 2D projections is made by the computer 14, which determines the intrinsic imaging parameters using the known geometric positions of the marks 20 in the second coordinate system K2 and the distance relations of the imaging marks 20' in the 2D projections, which is accomplished by means of suitable pattern detection, as disclosed in column 7 lines 12-20. However, Schuetz fails to disclose exactly how this is done, and more particularly, fails to disclose

"the position of the marking elements in the image is determined by a correlation of the image with at least one filter image of the pattern of the marking elements". However, the examiner maintains that it was well known in the art at the time of the invention, as taught by Seeley.

25. In a similar field of endeavor, Seeley discloses a fluoroscopic tracking and visualization system. In addition, Seeley discloses that one suitable protocol takes a candidate marker Pi in image coordinates, assumes it is marker number Qj of sheet one, and then determines how many other candidate markers support this match, i.e. line up with the expected projections of the remaining markers of one array, as disclosed in column 12 lines 21-33, which reads on claimed "the position of the marking elements in the image is determined by a correlation of the image with at least one filter image of the pattern of the marking elements".

26. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Schuetz, by specifically providing "the position of the marking elements in the image is determined by a correlation of the image with at least one filter image of the pattern of the marking elements", as taught by Seeley, for the purpose of determining the intrinsic imaging parameters using the known geometric positions of the marks 20 in the second coordinate system K2 and the distance relations of the imaging marks 20' in the 2D projections by means of suitable pattern detection.

27. Regarding **claim 3**, the combination of Schuetz and Seeley discloses everything as applied above in regards to claim 2. In addition, the combination discloses "the filter image of the pattern is transformed relative to the actual pattern of the marking

elements". Therefore, the examiner maintains that it was well known in the art at the time of the invention, as taught by Seeley.

28. Seeley discloses that that one suitable protocol takes a candidate marker Pi in image coordinates, assumes it is marker number Qj of sheet one, and then determines how many other candidate markers support this match, i.e. line up with the expected projections of the remaining markers of one array, as disclosed in column 12 lines 21-33, which reads on claimed "the filter image of the pattern is transformed relative to the actual pattern of the marking elements".

29. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Schuetz, by specifically providing "the filter image of the pattern is transformed relative to the actual pattern of the marking elements", as taught by Seeley, for the purpose of determining the intrinsic imaging parameters using the known geometric positions of the marks 20 in the second coordinate system K2 and the distance relations of the imaging marks 20' in the 2D projections by means of suitable pattern detection.

30. *Claim 4* is rejected under 35 U.S.C. 103(a) as being unpatentable over Schuetz in view of Simon et al. (US Patent 6,118,84), hereinafter referenced as Simon.

31. Regarding **claim 4**, Schuetz discloses an X-ray source 9 and X-ray detector 10, as disclosed in column 6 lines 44-46, which reads on claimed "the image is generated by means of radioscopy". Schuetz discloses that should the imaged marks 20' prove disturbing in the 2D projections, the imaged marks 20' can subsequently be calculated

out of the 2D projections in an image processing step, as disclosed in column 6 lines 63-67 and column 7 lines 1-2. However, Schuetz does not disclose how this is done, and more particularly fails to disclose "the marking elements exhibit a low absorption of the X-rays, the effect of which lies within the noise level of the X-ray image". However, the examiner maintains that it was well known in the art at the time of the invention, as taught by Simon.

32. In a similar field of endeavor, Simon discloses system and methods for the reduction and elimination of image artifacts in the calibration of x-ray imagers. In addition, Simon discloses In addition, Simon discloses that one the offset of a particular image has been determined, processor 303 proceeds with eliminating the artifacts by identifying the calibration marker projections, and, for each identified projection, subtracting the acquired offsets from the pixels of the projection, wherein ideally steps 901-904 will completely eliminate the artifacts from the image while leaving the true underlying image, but practically image noise may prevent a perfect result, as disclosed in column 7 lines 20-29, wherein the calibration markers are semi-transparent, as disclosed in column 7 lines 1-4, which reads on claimed "wherein the image generated by means of radioscopy, and the marking elements exhibit a low absorption of the X-rays, the effect of which lies within the noise level of the X-ray image".

33. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Schuetz, by specifically providing "wherein the image generated by means of radioscopy, and the marking elements exhibit a low absorption of the X-rays, the effect of which lies within the noise level of the X-ray image", as

taught by Simon, for the purpose of when the imaged marks 20' prove disturbing in the 2D projections, the imaged marks 20' can subsequently be calculated out of the 2D projections in an image processing step.

34. *Claim 5* is rejected under 35 U.S.C. 103(a) as being unpatentable over Schuetz in view of Erbel et al. (US Patent Application 2002/0122530), hereinafter referenced as Erbel.

35. Regarding **claim 5**, Schuetz discloses everything as applied above in regards to claim 1. However, Schuetz fails to disclose "wherein the position of at least one further object is determined in the image, wherein a second pattern of marking elements, which do not show up individually in the image, is attached to the further object, and wherein the second pattern is different from the first pattern". However, the examiner maintains that it was well known in the art at the time of the invention, as taught by Erbel.

36. In a similar field of endeavor, Erbel discloses a method for producing or updating a radiotherapy plan. In addition, Erbel discloses a computer tomography, wherein a calibration phantom 5 comprises inner marking rods and outer point markers 5 arranged on its bed 6, as disclosed in paragraph 32 and exhibited in figure 4, and further discloses patient marking having the reference numeral 7, as disclosed in paragraph 33 and exhibited in figure 5, which reads on claimed "wherein the position of at least one further object is determined in the image, wherein a second pattern of marking elements, which do not show up individually in the image, is attached to the further object, and wherein the second pattern is different from the first pattern".

37. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Schuetz, by specifically providing "wherein the position of at least one further object is determined in the image, wherein a second pattern of marking elements, which do not show up individually in the image, is attached to the further object, and wherein the second pattern is different from the first pattern", as taught by Erbel, for the purpose of detecting the position of both the bed and the patient.

38. *Claims 8 and 12* are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuetz in view of Close et al. (US Patent 5,774,521), hereinafter referenced as Close.

39. Regarding **claim 8**, Schuetz discloses everything as applied above in regards to claim 6. However, Schuetz fails to disclose "the pattern of marking elements is a two-dimensional maximum-length sequence". However, the examiner maintains that it was well known in the art at the time of the invention, as taught by Close.

40. In a similar field of endeavor, Close discloses a regularization technique for densitometric correction. In addition, Close discloses that in the preferred embodiment, the calibration phantom is designed such that the phantom density is spatially uncorrelated to the subject density, wherein in the preferred embodiement, the phantom density is a constant term plus uncorrelated Gaussian distributed random noise, having a flat power spectrum of spatial frequencies and nearly uniform local variance, and thus the noise at each pixel of the phantom is preferably a random number having a Gaussian distribution and a variance that is uniform for all pixels, as disclosed in column 5 lines 55-67, and column 6 lines 1-2, which reads on claimed "the pattern of marking

elements is a two-dimensional maximum-length sequence", since the two-dimensional maximum-length sequence is used because of its good correlation behavior, and is thus equivalent to the method disclosed by Close.

41. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Schuetz, by specifically providing "the pattern of marking elements is a two-dimensional maximum-length sequence", as taught by Close, for the purpose of having the calibration phantom being designed such that the phantom density is spatially uncorrelated to the subject density.

42. Regarding **claim 12**, Schuetz discloses everything as applied above in regards to claim 9. However, Schuetz fails to disclose "said pattern is a two-dimensional, cyclical binary maximum-length sequence". However, the examiner maintains that it was well known in the art at the time of the invention, as taught by Close.

43. In a similar field of endeavor, Close discloses a regularization technique for densitometric correction. In addition, Close discloses that in the preferred embodiment, the calibration phantom is designed such that the phantom density is spatially uncorrelated to the subject density, wherein in the preferred embodiement, the phantom density is a constant term plus uncorrelated Gaussian distributed random noise, having a flat power spectrum of spatial frequencies and nearly uniform local variance, and thus the noise at each pixel of the phantom is preferably a random number having a Gaussian distribution and a variance that is uniform for all pixels, as disclosed in column 5 lines 55-67, and column 6 lines 1-2, which reads on claimed "said pattern is a two-dimensional, cyclical binary maximum-length sequence", since the two-dimensional,

cyclical binary maximum-length sequence is used because of its good correlation behavior, and is thus equivalent to the method disclosed by Close.

44. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Schuetz, by specifically providing "said pattern is a two-dimensional, cyclical binary maximum-length sequence", as taught by Close, for the purpose of having the calibration phantom being designed such that the phantom density is spatially uncorrelated to the subject density.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel Zeilberger whose telephone number is (571)270-3570. The examiner can normally be reached on M-F 7:30-5pm est (alternate Fridays off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jefferey Harold can be reached on (571)272-7519. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Daniel Zeilberger
Examiner
Art Unit 4115

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11/05/2007
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